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PENSOFT

First record of *Apocorophium acutum* (Chevreux, 1908) (Amphipoda, Corophiidae, Corophiinae) from Uruguay, with notes on the biology and distribution

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Abstract
The amphipod *Apocorophium acutum* (Chevreux, 1908) has a worldwide distribution due to dispersion by ballast water and the hulls of ships. Here we provide a record of this species from Rocha department, Uruguay, which is the first record in the Atlantic South American coast. This record is 5,400 km from the nearest previously known record in Venezuela. Images and morphological characteristics are provided to distinguish from other species of Corophiidae previously recorded in the country.

Key words
South Atlantic, amphipod, hard substrate, range extension.

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Introduction

Species of the genus *Apocorophium* (Bousfield & Hoover, 1997) are mostly tube builders, inhabiting U-shaped tubes and are selective deposit feeders, feeding on bacteria, algae and diatoms adsorbed on the surface of the sediment particles. *Apocorophium acutum* (Chevreux, 1908) inhabits coastal environments of tropical and subtropical climate, in mud bottoms, on artificial hard substrates (Winfield et al. 2007, 2011) and on hydrozoans (Gavira-O'Neil et al. 2015), sponges (Winfield et al. 2011) and algae (Zakhama-Sraieb et al. 2006). This species is possibly gregarious and presents parental care of its offspring (Winfield et al. 2011). They are detritivores and also carnivores, preying on interstitial organisms. They have a longevity that varies between 0.5 and 1.5 years (Winfield et al. 2011).

Described for the first time for the Mediterranean (Chevreux 1908, Chevreux and Fage 1925), *A. acutum* currently has a worldwide distribution, having as its main vector the hulls and ballast water of ships (Winfield 2011). This species has been recorded from Japan (Irie 1957, 1958), Korea (Jung and Kim 2007), Brunei (Hossain and Hughes 2016), Spain (Ros and Guerra-García 2012, Gavira-O'Neil et al. 2015), South Africa (Mead et al. 2011), Tunisia (Zakhama-Sraieb et al. 2006), United States (Bousfield 1973, 1997, Lecroy 2004) Gulf of Mexico (Winfield et al. 2006, 2007, 2011) and Venezuela (Martin et al. 2002).

This species has been classified as invasive in Mexico due to the negative effects they might have on native invertebrates, reducing their richness and abundance and altering ecological processes related to food chains (Win-

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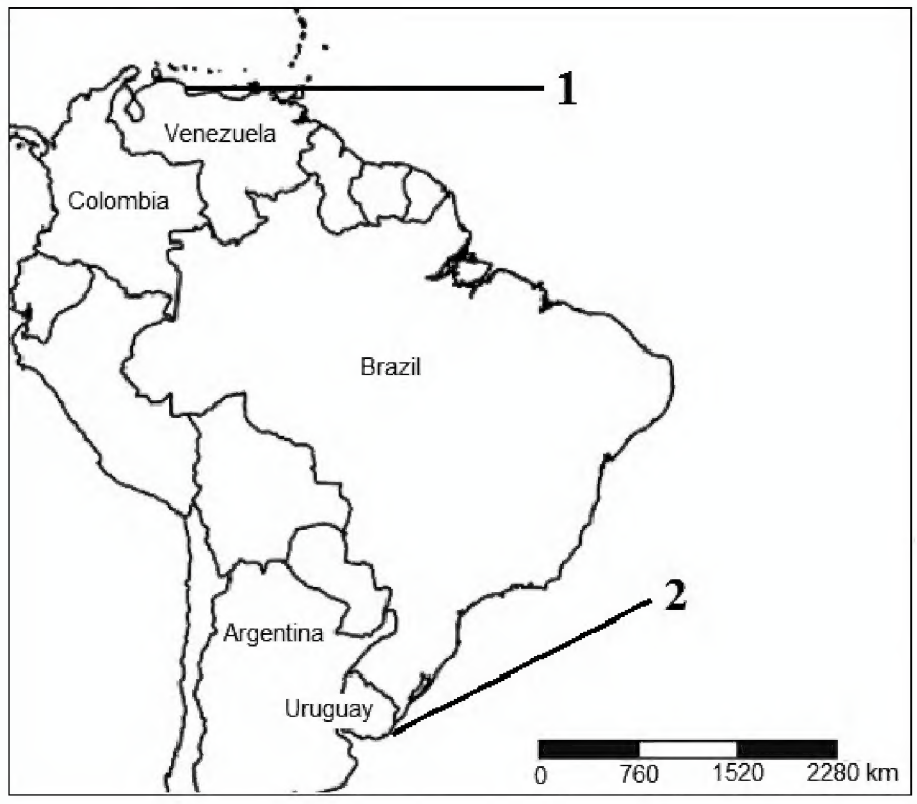

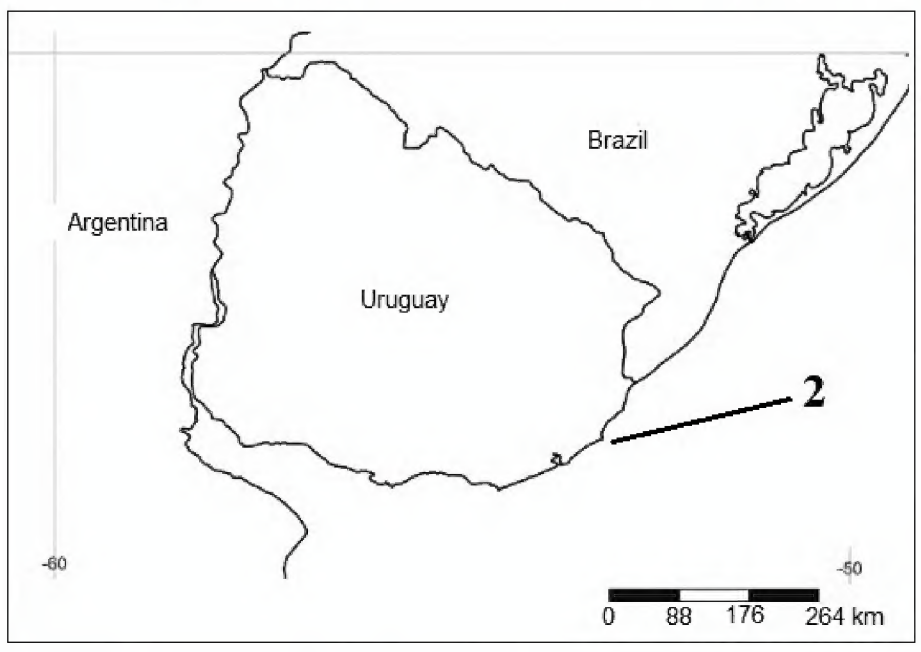

Figure 1. Nearest previous record of *Apocorophium acutum* (Chevreux, 1908) in the state of Falcón, Venezuela (1) and our records for Rocha department, Uruguay (2).

field et al. 2011). This species is also classified as invasive in Brunei (Hossain and Hughes 2016). Currently invasive potential of this species in Uruguay is unknown. The aim of this paper is to report the occurrence of *A. acutum* for the first time in Uruguay, with description, images and illustrations, referring morphological variation.

Methods

The specimens of *Apocorophium acutum* recorded from Uruguay were collected during a study of crustacean communities on artificial substrates at the town of La Paloma, Rocha department, Uruguay, in the subtidal coastal zone at a depth of 1.5 m (Fig. 1). Samples were taken bimonthly from March 2013 to March 2014 with 6 artificial substrates by removing the community on the surfaces using quadrants and scraping. The specimens were fixed in 4% formaldehyde, preserved in 70% alcohol, and examined using a Premiere BM 2100 stereomicroscope. A total of 336 females of *A. acutum* was found, and 10 of them were dissected and drawn. The material was deposited in the Entomological collection of Facultad de Ciencias, Universidad de la República (FCC). The distribution map was made using a SimpleMappr (Shorthouse 2010). The determination of the specimens was done following the keys of Bousfield and Hoover (1997), LeCroy (2004) and Jung and Kim (2007).

Results

Order Amphipoda Latreille, 1816
Infraorder Corophiida Lowry & Myers, 2013
Family Corophiidae Dana, 1849
Subfamily Corophiinae Bousfield & Hoover, 1997
Genus *Apocorophium* Bousfield & Hoover, 1997

Apocorophium acutum (Chevreux, 1908)
Figures 2, 3

Materials examined. Uruguay, Rocha, La Paloma locality, Bahía Chica area (34°39′48″ S, 054°09′02″ W), subtidal, 1.5 m, on artificial hard substrate, coll. A. Demicheli, March, September and November 2013 (10 female specimens, FCC400).

Description. Female. Body short and broad, 2.00–2.50 mm long. Rostrum short, not exceeding or slightly exceeding lateral ridge of head (Fig. 2), lateral ridge produced.

Antenna 1 (Fig. 3D) short, relative length of peduncular segments 1–3 7:6:3, peduncular segment 1 with two robust setae near proximal end of inner margin, flagellum about half as long as peduncle, consisting of 4 segments, last 3 segments with aesthetasc. Antenna 2 (Fig. 3C) stout and short, gland cone at peduncular segment 2 short, peduncular segment 3 with 2 ventrodistal robust setae, peduncular segment 4 with 2 ventromedial robust setae and 1 ventrodistal robust setae, peduncular segment 5¾ as long as peduncular segment 4 with a ventrodistal triangular process, flagellum short, 3-segmented, terminal segment with 2 obtuse robust setae.

Mandible developed, incisor produced inward, with three acute teeth, lacinia mobilis with 2 accessory blades, molar developed, palp composed of 2 segments, palpal segment 1 with short and bent pinnate seta at distal end, palpal segment 2 as long as palpal segment 1, with long and bent pinnate seta. Maxilla 1 (Fig. 3H), outer plate with six bifid robust setae, palp short, biarticulate, palpal proximal segment very short, palpal terminal segment with eight robust setae. Maxilliped (Fig. 3G) inner plate short, outer plate slender, palp composed of 4 segment, palp segment 4 with spine on apex.

Gnathopod 1 (Fig. 3A), coxa oval, basis nearly equal in length to carpus, gradually increasing in width apically, posterior margin rounded, ischium short, expanded anterodistally, posterodistal margin surrounded by several long setae, merus as long as ischium, posterodistal end with 1 simple setae, carpus slightly shorter than basis, anterior margin rounded, anterodistal margin with one simple seta, posterior margin with 2 longitudinal rows of plumose setae, propodus slender, slightly shorter than carpus, posterior margin with several setae, palm slightly oblique, slightly rounded posteriorly, with several robust

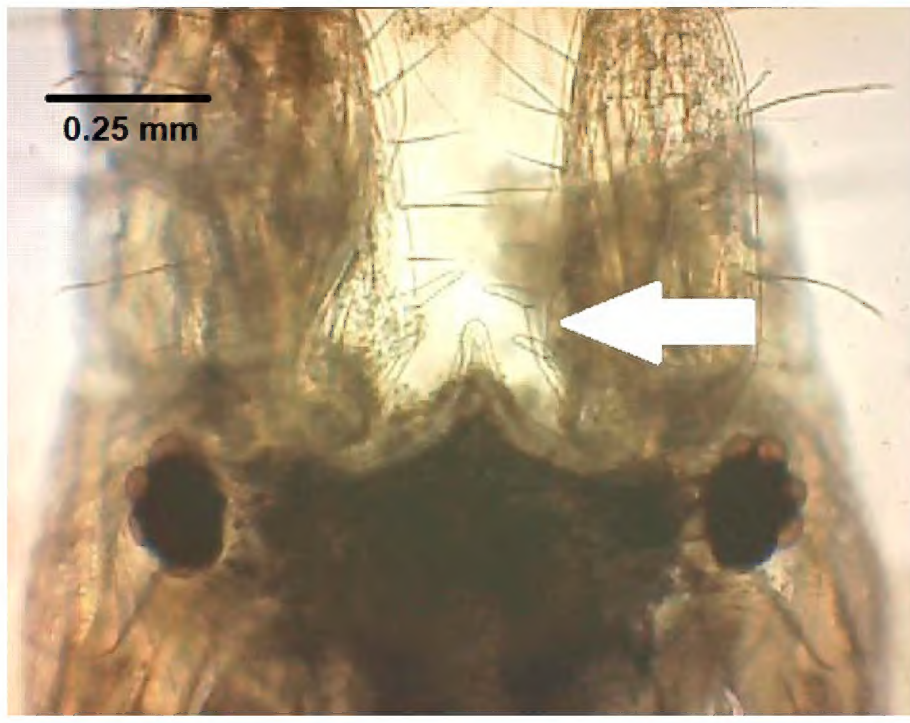

Figure 2. *Apocorophium acutum* (Chevreux, 1908). Female head (body length: 2.30 mm), La Paloma locality, Rocha, Uruguay (FCC 400). Antenna 1 peduncular segment 1 with 2 distinctive robust setae near proximal end of inner margin (at arrow).

setae, dactylus slightly extending beyond palm, with a weak posterior marginal tooth.

Gnathopod 2 (Fig. 3B), coxa crescent-shaped, with dorsal margin concave, posterodistal margin tapered, basis slightly increasing in width, ischium short, stout, rounded posteriorly, merus as long as basis, rounded posteriorly, with many long plumose setae in 2 rows, not occluding posterodistal margin of carpus, carpus about 8/11 as long as propodus, increasing in width, posterodistal margin with 1 plumose setae, gradually narrower toward apex in width, gently rounded anteroproximally, inner proximal part with 1 oblique row of 9 long plumose setae, dactylus with 2 posterodistal teeth.

Pereopod 3 (Fig. 3E), coxa anterior margin transverse, posterior tapered, ventral margin rounded, basis about ⅓ as long as pereopod 3, anterior margin rounded, with 3 short setae, posterior margin slightly rounded, with 1 short seta, ischium short, as long as wide, merus about half as long as basis, gradually extending apically, anterodistal margin with 6 setae, carpus very short, partly overhung anteriorly by merus, posterior margin with 5 setae, propodus gradually decreasing in width apically, dactylus slightly longer than propodus, curved.

Pereopod 4, similar in size and shape with pereopod 3.

Pereopod 5, coxa dorsoventrally depressed, slightly narrowed posteriorly, anterior and posterior margin rounded, ventral margin slightly concave, basis about ⅓ as long as pereopod 5, anterior margin with 2 short setae, posterior margin with 1 short seta, ischium ¼ as long as basis, slightly protruded at posteromedian region, merus about 2 times longer than ischium, slightly expanded at posterodistal end, carpus half as long as merus, posteroproximal margin with 1 transverse row of 3 robust setae, posterodistal end surrounded by 4 robust setae, propodus 2 times longer than carpus, slender, uniform in width, dactylus small, curved.

Pereopod 6, overall similar to pereopod 5, except slightly longer than pereopod 5, with 6 plumose setae at posterior margin of basis.

Pereopod 7, coxa ventrally rounded, dorsally straight, basis about ⅓ as long as pereopod 7, anterior and posterior margin expanded, anterior margin with 16 long plumose setae, posterior margin with 21 long plumose setae, ischium short, slightly protruded posteriorly, anterodistal end with 1 short seta, merus about half as long as basis, uniform in width, carpus as long as merus, propodus ¾ as long as basis, narrower than carpus, uniform in width, anterior margin with 2 setae, posterior margin with 4 setae, distal end with 7 long setae, dactylus short, curved.

Urosome (Fig. 3F) fused, lateral margin entire and setose, uropod 1 and 2 arising ventrally.

Uropod 1 (Fig. 3F) not extending beyond uropod 2, peduncle 2 times as long as rami, outer margin with 4 robust setae, outer ramus with 5 robust setae and 1 stout robust setae on apex, uropod 2¾ as long as peduncle of uropod 1, peduncle about twice as long as rami, exterior margin slightly inflated, rami gradually narrowing apically, spine on each apex, uropod 3 slightly shorter than uropod 2, uniramous, peduncle shorter and slightly broader than ramus, outer margin rounded, ramus large with 6 distal setae.

Telson (Fig. 3F) fleshy, small, broad, subtriangular, armed with 4 short setae.

Habitat. Coastal environments in mud bottoms, artificial hard substrates (Winfield et al. 2007, 2011), and epifaunal on hydrozoans (Gavira-O'Neil et al. 2015) and algae (Zakhama-Sraieb et al. 2006).

Distribution. Tropical and temperate waters worldwide, including: Asia (Irie 1957, 1958, Jung and Kim 2007), Africa (Mead et al. 2011), Mediterranean (Chevreux 1908, Chevreux and Fage 1925, Zakhama-Sraieb et al. 2006), North America (Bousfield 1973, 1997, Lecroy 2004) and Caribbean (Winfield et al. 2006, 2007, 2011, Martin et al. 2002).

Discussion

The examined specimens coincided with previous descriptions except for the followings differences: female: antenna 1 with less separation between the 2 robust setae in the inner margin of proximal end than description of Bousfield (1997) and Jung and Kim (2007) and less setose than description of LeCroy (2004). Antenna 2 more setose and with 2 robust setae in ventral margin instead of 3 described in Bousfield (1997), LeCroy (2004) and Jung and Kim (2007). Pereopod 3 merus with 6 setae in the anterior margin instead of 3 described in Jung and Kim (2007). Telson slightly more rounded than description of Bousfield (1997) and Jung and Kim (2007). The morphological differences found in this study could be attributed to local variations, as noted by Jung and Kim (2007) for specimens found in Korea.

The presence of the species on artificial substrates in the subtidal area agree with the observed in other parts of

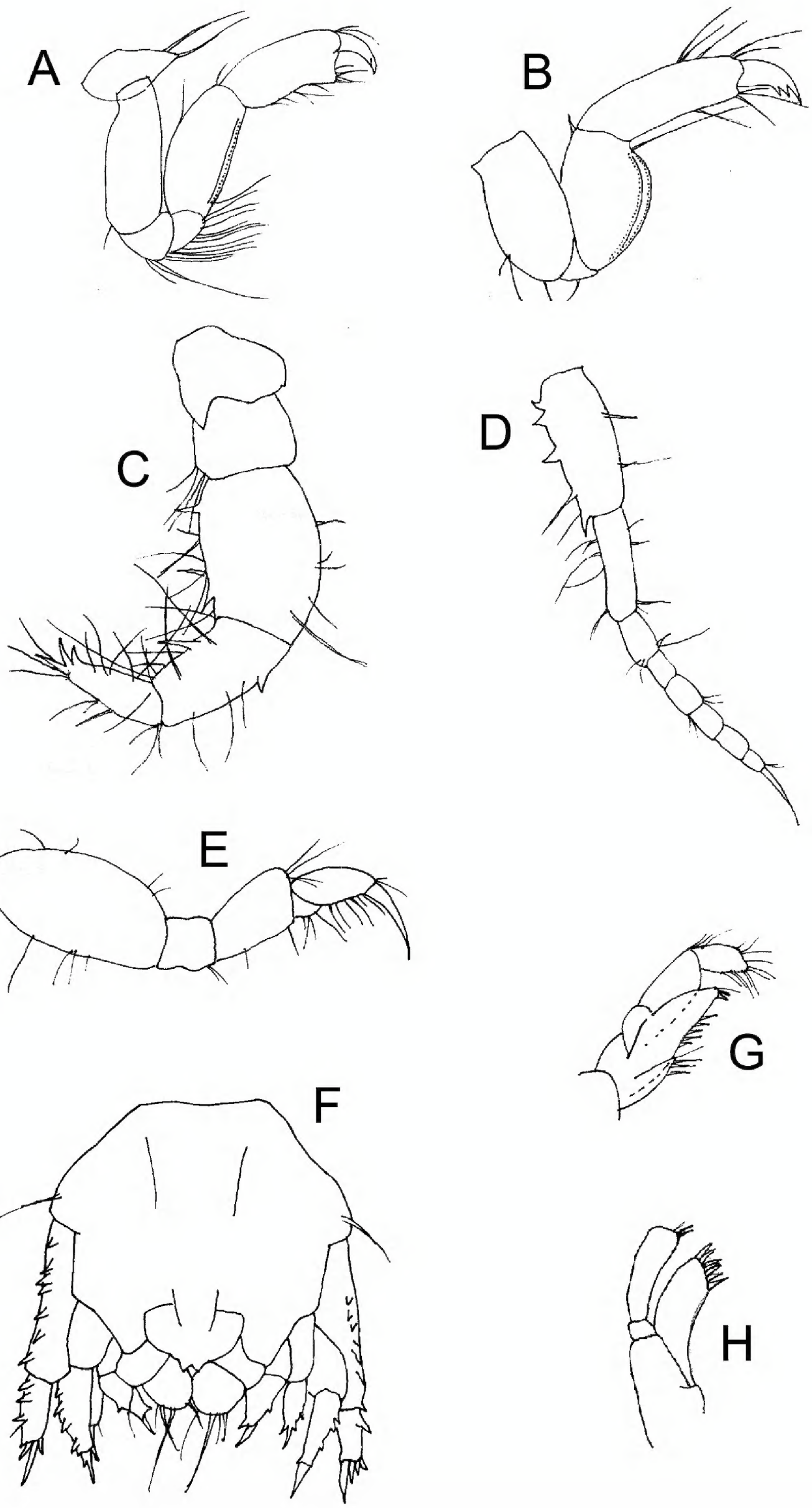

Figure 3. *Apocorophium acutum* (Chevreux, 1908). Female (body length: 2.30 mm), La Paloma, Rocha, Uruguay (FCC400). **A.** Gnathopod 1. **B.** Gnathopod 2. **C.** Antenna 2. **D.** Antenna 1 **E.** Pereopod 3. **F.** Urosome, uropods and telson. **G.** Maxilliped. **H.** Maxilla 1. Scale bar = 1 mm (A–F), 0.25 mm (G, H).

the world (Winfield et al. 2011). It is highly probable that the introduction of this species in Uruguay was due to hulls and ballast water of ships, as observed for other regions, as there is an international port at La Paloma (Demicheli and Scarabino, 2006) and a major commercial port in Montevideo, the capital of Uruguay (Muniz et al. 2004). The amphipod *Monocorophium insidiosum* (Crawford, 1937), previously recorded for Uruguay, is very similar to *A. acutum*, and its co-ocurrence probably accounted for the overlooking of *A. acutum*. The record of *A. acutum*

from Uruguayan coast, around 5,400 km of distance from the nearest register represent a significant range extension Southward for this species, and his detection and monitoring is relevant due to his invasive potential, previously mentioned for other parts of his distribution area (Winfield et al. 2011, Hossain and Hughes 2016).

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Authors' Contributions

ÁD collected the specimens, prepared the drawings and the manuscript. AV and ÁD examined and identified the specimens, reviewed and finalized the manuscript. Both authors read and approved the manuscript.

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